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FIXING DEVICE

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PUBLISHED: January 17, 1995 (19950117)
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ABSTRACT

PURPOSE: To improve the service life and the heat efficiency of a positive temperature coefficient resistance heating element by using a metallic seamless belt as a fixing belt and restraining the surface roughness of the belt to be under a specified value.

CONSTITUTION: The metallic seamless belt by an electric casting process is used as the fixing belt 3, and further the rougness of the surface of the belt in contact with the temperature coefficient resistance heating element 2 is restrained to be <0.5.mu.m. Thus, the abrasion loss of the surface of the heating element 2 is reduced, the life thereof is improved, and further the heat efficiency of the heating element 2 is improved. By using the metallic belt by the electric casting process, the heat conductivity from the heating element 2 is improved. Therefore, even when the belt is used for a long time, the change of film diameter caused by heat expansion and the change of the frictional force of the heating element 2 and the film are restrained to be small, and the movement of the belt in an axial direction and wrinkling are prevented.

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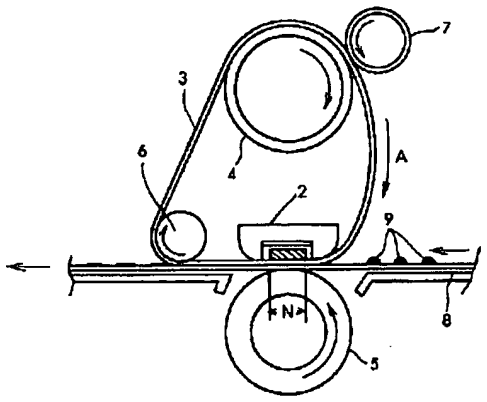
(54)【発明の名称】　定着装置

(57)【要約】

【構成】ベルト式定着装置１の定着ベルト３を、電鋳プロセスにより製造し、正温度係数抵抗素子発熱体２に接する面の凹凸が大きい場合は、平滑化処理を行い、正温度係数抵抗素子発熱体２に接する面の表面あらさが０．５μｍ未満の滑らかな面を有し厚さが４０μｍ前後のＮｉの定着ベルト３を用いた定着装置。

【効果】金属性の定着ベルトを用いたベルト式定着装置において、正温度係数抵抗素子発熱体に接する面の表面あらさが０．５μｍ未満の定着ベルトを装着した構成により、正温度係数抵抗素子発熱体の寿命，熱効率が向上する。

図　2



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【特許請求の範囲】

【請求項1】用紙上に形成された未定着トナー像を、耐熱性のシームレスベルトを介して加熱溶融し、用紙上にトナー像を定着させる定着装置において、トナー像を加熱溶融する発熱体に接触しながら移動する上記シームレスベルトに、金属性のシームレスベルトを用い、前記発熱体に接する面の表面あらさが0.5μm 未満であることを特徴とする定着装置。

【請求項2】請求項1における前記シームレスベルトを電鋳プロセスによるNiの金属ベルトとした定着装置。

【請求項3】請求項1における前記シームレスベルトを電鋳プロセスにより表面あらさが0.5μm 未満の母材で製作した定着装置。

【請求項4】請求項1における前記シームレスベルトの裏面の表面あらさが大きいベルトを二本のローラで挟持し、前記二本のローラに圧力を加えながら回転させることにより、発熱体に接する面の凹凸を除去した定着装置。

【請求項5】請求項1におけるトナー像を加熱溶融する発熱体に、正温度係数抵抗素子発熱体を用いた定着装置。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は発熱体として正温度係数抵抗素子を用いて、その熱エネルギをベルトを介して記録材に付与する方式の定着装置に関する。

【0002】

【従来の技術】従来、複写機，光プリンタ等の画像形成装置に用いられている定着装置として、内部にヒータを有した加熱ローラと、弾性層で被覆され加熱ローラに圧接する加圧ローラで構成された熱ローラ定着方式が広く使用されていた。しかし、加熱ローラのウォームアップタイムが長い，消費電力が大きい等の欠点があった。

【0003】そこで、これらの欠点を克服するベルト定着方式が種々提案されている。このベルト定着方式は、発熱体にベルトを接触させて移動し、ベルトの発熱体側とは反対の面に記録材を加圧密着してベルトとともに発熱体位置を移動通過させ、発熱体からベルトを介して記録材に熱エネルギを与える方式である。

【0004】このベルト定着方式におけるベルトに関して、特開平3－25475号公報では、ポリイミド等の耐熱樹脂のフィルムを用い、フィルムの発熱体側の面の表面あらさを0.5μm 以上7μm以下と限定し、フィルムの片寄り，しわの発生を防止している。

【0005】

【発明が解決しようとする課題】フィルムの発熱体側の面の表面あらさ0.5μm 以上7μm以下のフィルムが発熱体と摺動する際、初期の凹凸，摺動を繰り返すことによって削り取られた突起の発熱体とフィルム間への堆積によって、発熱体の表面が摩耗し、発熱体の寿命が低下する、突起物の堆積によって発熱体からフィルムへの熱伝導率が低下して発熱体の熱効率が低下するという問題が発生する。さらに、エンドレス状の樹脂フィルムを長時間使用した場合、熱膨張によるフィルム径の変化，発熱体とフィルムとの摩擦力の変化により、フィルムが軸方向に移動してしまったり、しわが発生する等の問題もある。

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【0006】

【課題を解決するための手段】本発明は、用紙上に形成された未定着トナー像を、耐熱性のシームレスベルトを介して加熱溶融し、用紙上にトナー像を定着させる定着装置において、電鋳プロセスによる金属性のシームレスベルトを用い、さらに、ベルトの発熱体に接する面の表面あらさを0.5μm 未満に抑えるようにした。

【0007】

【作用】ベルト定着装置のシームレスベルトの正温度係数抵抗素子発熱体に接する面の表面あらさを0.5μm 未満に抑えることにより、正温度係数抵抗素子発熱体表面の摩耗量を低減し、寿命の向上が図られ、さらに、発熱体の熱効率の向上も図ることができる。また、電鋳プロセスによる金属性のベルトを用いることにより、正温度係数抵抗素子発熱体からの熱伝導率がよく、長時間使用した場合でも、熱膨張によるフィルム径の変化，発熱体とフィルムとの摩擦力の変化が小さく、ベルトの軸方向への移動，しわの発生等を防止できる。

【0008】

【実施例】以下、本発明の実施例を図面を用いて説明する。

【0009】図1に本発明の定着装置を適用した電子写真装置の断面図を示す。ホッパ内に堆積した用紙8を一枚ずつ分離給送して、屈曲ガイド12へ搬送する。搬送ローラ10により、用紙8は感光ドラム15上のトナーが転写される転写部へ搬送される。感光ドラム15上のトナー像は現像機16により可視化される。その後、用紙8は金属のシームレスの定着ベルト3，駆動プーリ4，正温度係数抵抗素子発熱体2，加圧ローラ5，剥離ローラ6，補助ローラ7からなるベルト式定着装置1へ搬送され、トナー像は用紙8へ定着される。定着後の用紙8は、搬送ローラ14により屈曲ガイド13へ送られ、搬送ローラ11によりアウトプットトレイへ搬出される。

【0010】図2にベルト式定着装置1の構成を示す。以下、その動作を説明する。

【0011】定着ベルト3は、駆動プーリ4によって矢印Aの方向へ回転し、未定着トナー9をのせた用紙8と共に正温度係数抵抗素子発熱体2と加圧ローラ5に接するニップ部Nに搬送される。そして、正温度係数抵抗素子発熱体2の熱により加熱され、空気によって十分冷却された後、剥離ローラ6によって用紙8と分離される。そのため、用紙8上の未定着トナー9は、ニップ部Nで

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加熱されて溶融後、冷却されて用紙8に固着し定着ベルト3と分離されるため、高温オフセットが生じない。

【0012】定着ベルト3は、正温度係数抵抗素子発熱体2の熱が瞬時にトナー及び用紙8に伝わるように十分薄く、用紙8と接触する面にはフッ素系樹脂層が施されている。一例として、厚み30μmのNiの基材の表面に導電材を添加したPTFE（四フッ化エチレン樹脂）を20μmの厚みで被覆したものである。

【0013】駆動プーリ4と補助ローラ7の表面には、耐熱性の高摩擦係数を有するシリコーンゴムが被覆されており、駆動プーリ4と定着ベルト3との滑りを防いでいる。尚、シリコーンゴムの他に、駆動プーリ4の表面に微小な凹凸を付けるローレット処理を施してもよい。加圧ローラ5の形状は、用紙のしわを防止するため逆クラウン形状になっている。

【0014】次に本発明における定着ベルト3について説明する。まず、電鋳プロセスについて説明する。図3に電鋳プロセスの概略図を示す。金属（例えばNi）のメッキ液18の中に、定着ベルト3の内径に等しい金属性の母材17を浸し、この母材17とメッキ液18を電極19で接続して電圧をかけることにより、金属のメッキ液18のイオンが母材17の表面に付着し薄膜を形成する。この時、電圧をかける時間を制御することにより、所定の膜厚を得ることができる。所定の膜厚が得られた後、母材17から剥がされ、継ぎ目のない定着ベルト3ができあがる。このプロセスにより作られた定着ベルト3の、正温度係数抵抗素子発熱体2に接する面（裏面）の表面あらさの状態を図5，図6に示す。図に示すように、母材17の表面あらさの状態によって、定着ベルト3の裏面のあらさが左右される。図5のように、母材17の凹凸が大きい場合、定着ベルト3の裏面には0.5μm以上の凹凸（突起）が全面にみられる。この状態で定着ベルト3と正温度係数抵抗素子発熱体2を摺動させた場合、正温度係数抵抗素子発熱体2の定着ベルト3と接する面は、突起によって摩耗する。さらに摺動を続けると、定着ベルト3の突起が削れ、正温度係数抵抗素子発熱体2と定着ベルト3の間に堆積し、正温度係数抵抗素子発熱体2の摩耗を増大させ、寿命を低下させる。図4に、定着ベルト3の裏面の表面あらさと正温度係数抵抗素子発熱体2の摩耗量の関係を示す。表面あらさが大きくなると正温度係数抵抗素子発熱体2の摩耗量が多くなる。また、突起物の堆積によって、正温度係数抵抗素子発熱体2と定着ベルト3の間に空気の層ができ、熱伝導が悪くなり、正温度係数抵抗素子発熱体2の熱効率を低下させてしまい、画質の劣化を招いてしまう。そこで、本発明は、図6に示すような、定着ベルト3の裏面の表面あらさが0.5μm 未満の平滑な定着ベルト3を用いる。この定着ベルト3は、電鋳プロセスにより製作された後、裏面のあらさが大きいものは図7に示すような方法によって、凹凸を除去する。この後処理

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を行うことによっても、表面あらさ0.5μm 未満の定着ベルト3が得られる。

【0015】図7は、ローラ20，ローラ21の二本のローラを用いて、定着ベルト3の裏面の凹凸を除去する方法である。定着ベルト3をローラ20，ローラ21との間に回転可能な状態で挟持し、ローラ20とローラ21にそれぞれ矢印で示した方向に押付力を作用させて、ローラ20とローラ21を等速で回転させる。押付力を作用させながら回転させることにより、定着ベルト3の裏面の凹凸を押しつぶし、平滑な面を得ることができる。

【0016】定着ベルト3は厚さが40μm前後と大変薄いため、ベルトの回転によるしわの発生等を考慮して金属ベルトを採用した。材質に関しては、熱伝導率が良く、しかも、他の金属に比べ熱膨張率が低いNiを用いた。Niは金属の中でも電鋳プロセスによる製造が容易というメリットもある。

【0017】以上の実施例による定着ベルト3をベルト式定着装置1に用いることにより、正温度係数抵抗素子発熱体2表面の摩耗量を低減し、寿命の向上が図られ、さらに、図8のベルト表面の温度データに示すように、発熱体の熱効率の向上も図ることができる。そして、電鋳プロセスによる金属性のベルトを用いることにより、正温度係数抵抗素子発熱体2からの熱伝導率がよく、長時間使用した場合でも、熱膨張によるベルト径の変化，しわの発生等を防止できる。

【0018】

【発明の効果】本発明によれば、ベルト式定着を適用した電子写真装置において、定着ベルトの正温度係数抵抗素子発熱体に接する面の表面あらさを0.5μm 未満とすることで、正温度係数抵抗素子発熱体表面の摩耗の低減，発熱体の熱効率の向上を図ることができる。また、電鋳プロセスによる金属性のベルト、特に熱伝導率が良く、熱膨張率が低いNiベルトを用いることにより、正温度係数抵抗素子発熱体からの熱伝導率がよく、熱膨張によるベルト径の変化，しわの発生等を防止でき、高画質の画像が得られる。

【図面の簡単な説明】

【図1】本発明の定着装置を適用した電子写真装置の断面図。

【図2】本発明の定着ベルトを適用したベルト式定着装置の断面図。

【図3】電鋳プロセスの説明図。

【図4】定着ベルト裏面の表面あらさと正温度係数抵抗素子発熱体表面の摩耗量の関係の説明図。

【図5】定着ベルト裏面の状態図（母材の凹凸大）。

【図6】定着ベルト裏面の状態図（母材の凹凸小）。

【図7】定着ベルト裏面の凹凸の除去方法の説明図。

【図8】正温度係数抵抗素子発熱部の定着ベルト表面の温度特性図。

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【符号の説明】

2…正温度係数抵抗素子発熱体、3…定着ベルト、4…駆動プーリ、5…加圧ローラ、6…剥離ローラ、7…補助ローラ、8…用紙、9…未定着トナー。

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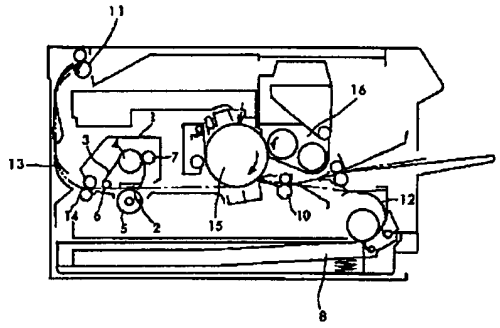
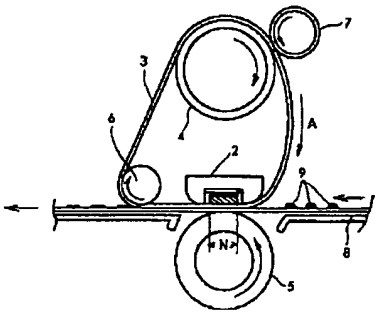
【図1】

図 1



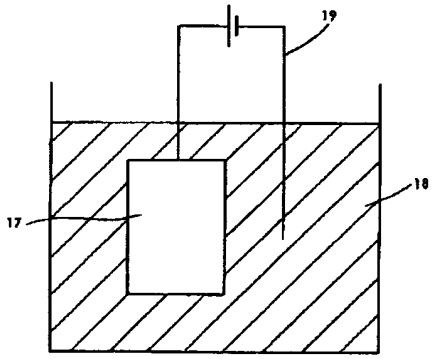
【図2】

図 2



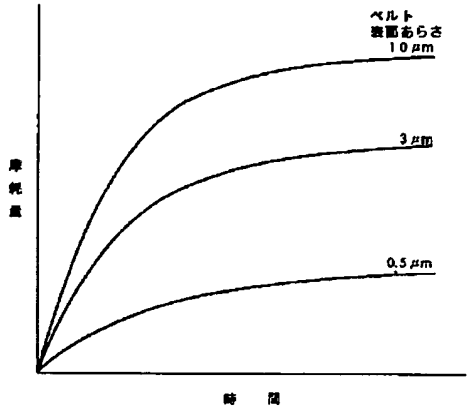
【図3】

図 3



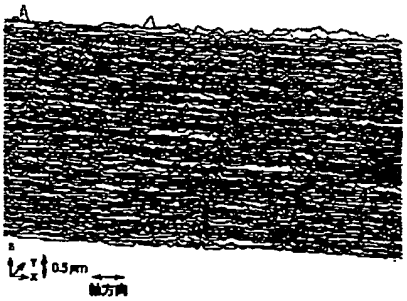
【図4】

図 4



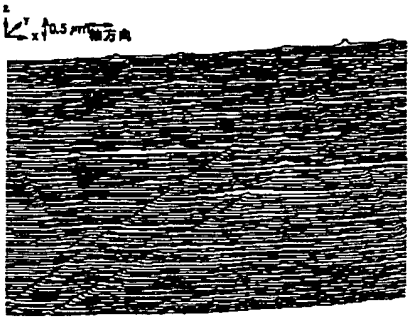
【図5】

図 5



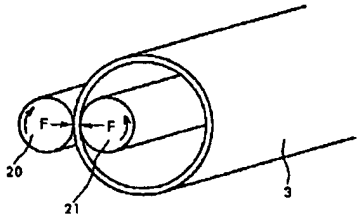
【図6】

図 6



【図7】

図 7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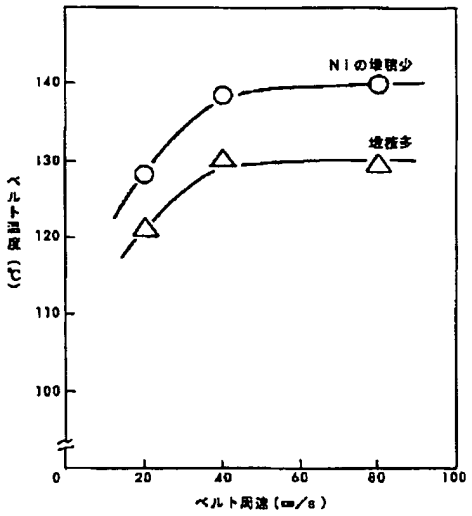
【図8】

図 8


Niの増積少
増積多
140
130
120
110
100
0
20
40
60
80
100
ベルト周速（cm/s）

* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] The surface roughness of the field which carries out heating fusion of the non-established toner image formed on the form through a heat-resistant seamless belt, uses a metallic seamless belt for the above-mentioned seamless belt which moves a toner image in the anchorage device which fixes a toner image on a form while contacting the heating element which carries out heating fusion, and touches said heating element is 0.5 micrometers. Anchorage device characterized by being the following.
[Claim 2] The anchorage device which used said seamless belt in claim 1 as the metal belt of nickel by the electrocasting process.
[Claim 3] Surface roughness is 0.5 micrometers by the electrocasting process about said seamless belt in claim 1. Anchorage device manufactured with the base material of the following.
[Claim 4] The anchorage device from which the irregularity of the field which touches a heating element by making it rotate, pinching a belt with the large surface-roughness of the rear face of said seamless belt in claim 1 with two rollers, and applying a pressure to said two rollers was removed.
[Claim 5] The anchorage device which used the forward temperature coefficient resistance element heating element for the heating element which carries out heating fusion of the toner image in claim 1.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the anchorage device of the method which gives the heat energy to record material through a belt, using a forward temperature-coefficient resistance element as a heating element.
[0002]
[Description of the Prior Art] Conventionally, the heat roller fixing method which consisted of pressurization rollers which it is covered with a heating roller with a heater and an elastic layer inside as an anchorage device used for image formation equipments, such as a copying machine and an optical printer, and carry out a pressure welding to a heating roller was used widely. However, there was a fault, like power consumption with the long warm uptime of a heating roller is large.
[0003] Then, the belt fixing method which conquers these faults is proposed variously. This belt fixing method is a method which a belt is contacted to a heating element, moves it to it, carries out pressurization adhesion of the record material in a field opposite to the heating element side of a belt, is made to carry out migration passage of the heating element location with a belt, and gives heat energy to record material through a belt from a heating element.
[0004] About the belt in this belt fixing method, the film of heat-resistant resin, such as polyimide, is used in JP,3-25475,A, and it is 0.5 micrometers about the surface roughness of the field by the side of the heating element of a film. It limited with 7 micrometers or less above, and the deviation of a film and generating of a wrinkling are prevented.
[0005]
[Problem(s) to be Solved by the Invention] Surface roughness of 0.5 micrometers of the field by the side of the heating element of a film In case a film 7 micrometers or less slides with a heating element above, the problem that the thermal conductivity from a heating element to a film falls, and the thermal efficiency of a heating element falls by the deposition of a projection to which the front face of a heating element is worn out and the life of a heating element falls by early irregularity, and the heating element of a projection shaved off by repeating sliding and deposition of a between [films] occurs. Furthermore, when an endless-like resin film is used for a long time, by change of the diameter of a film by thermal expansion, and change of the frictional force of a heating element and a film, a film moves to shaft orientations or there is also a problem of a wrinkling occurring.
[0006]
[Means for Solving the Problem] This invention is 0.5 micrometers about the surface roughness of the field which touches the heating element of a belt further using the metallic seamless belt by the electrocasting process in the anchorage device which heating fusion of the non-established toner image formed on the form is carried out [anchorage device] through a heat-resistant seamless belt, and fixes a toner image on a form. It was made to hold down to the following.
[0007]
[Function] It is 0.5 micrometers about the surface roughness of the field which touches the forward temperature coefficient resistance element heating element of the seamless belt of a belt anchorage device. By holding down to the following, the abrasion loss of a forward temperature coefficient resistance element heating element front face is reduced, improvement in a life is achieved, and improvement in the thermal efficiency of a heating element can also be aimed at further. Moreover, even when the thermal conductivity from a forward

temperature coefficient resistance element heating element is good and carries out long duration use by using the metallic belt by the electrocasting process, change of the diameter of a film by thermal expansion and change of the frictional force of a heating element and a film are small, and can prevent migration to the shaft orientations of a belt, generating of a wrinkling, etc.

[0008]

[Example] Hereafter, the example of this invention is explained using a drawing.

[0009] The sectional view of the electrophotography equipment which applied the anchorage device of this invention to drawing 1 is shown. Separation feed is carried out and it conveys at a time one sheet of form 8 deposited in the hopper to the crookedness guide 12. With the conveyance roller 10, a form 8 is conveyed to the imprint section by which the toner on a photoconductor drum 15 is imprinted. The toner image on a photoconductor drum 15 is visualized by the developing machine 16. Then, a form 8 is conveyed to the belt type anchorage device 1 which consists of the metaled seamless fixing belt 3, a driving pulley 4, the forward temperature-coefficient resistance element heating element 2, the pressurization roller 5, an exfoliation roller 6, and an auxiliary roller 7, and it is fixed to a toner image to a form 8. The form 8 after fixing is sent to the crookedness guide 13 with the conveyance roller 14, and is taken out with the conveyance roller 11 to an output tray.

[0010] The configuration of the belt type anchorage device 1 is shown in drawing 2 . Hereafter, the actuation is explained.

[0011] The fixing belt 3 rotates in the direction of an arrow head A by the driving pulley 4, and is conveyed by the nip section N which touches the forward temperature coefficient resistance element heating element 2 and the pressurization roller 5 with the form 8 which carried the non-established toner 9. And after it is heated by the heat of the forward temperature coefficient resistance element heating element 2 and being enough cooled by air, it is separated by the exfoliation roller 6 with a form 8. Therefore, the non-established toner 9 on a form 8 is heated in the nip section N, and after melting, since it is cooled, it fixes in a form 8 and it dissociates with the fixing belt 3, elevated-temperature offset does not produce it.

[0012] The fixing belt 3 is thin enough so that the heat of the forward temperature coefficient resistance element heating element 2 may get across to a toner and a form 8 in an instant, and the fluororesin layer is given to the field in contact with a form 8. As an example, PTFE (tetrafluoroethylene resin) which added electric conduction material on the front face of the base material of nickel with a thickness of 30 micrometers is covered with the thickness of 20 micrometers.

[0013] The silicone rubber which has heat-resistant high coefficient of friction is covered by the driving pulley 4 and the front face of the auxiliary roller 7, and slipping of a driving pulley 4 and the fixing belt 3 is prevented. In addition, knurling tool processing which attaches minute irregularity to the front face of a driving pulley 4 other than silicone rubber may be performed. The configuration of the pressurization roller 5 is a reverse crown configuration in order to prevent the wrinkling of a form.

[0014] Next, the fixing belt 3 in this invention is explained. First, a electrocasting process is explained. The schematic diagram of a electrocasting process is shown in drawing 3 . Into metaled (for example, nickel) plating liquid 18, by dipping the metallic base material 17 equal to the bore of the fixing belt 3, connecting plating liquid 18 with this base material 17 with an electrode 19, and applying an electrical potential difference, the ion of metaled plating liquid 18 adheres to the front face of a base material 17, and forms a thin film. At this time, predetermined thickness can be obtained by controlling the time amount to which an electrical potential difference is applied. After predetermined thickness is obtained, it is removed from a base material 17 and the fixing belt 3 without a joint is done. The condition of the surface roughness of the field (rear face) which touches the forward temperature coefficient resistance element heating element 2 of the fixing belt 3 made by this process is shown in drawing 5 and drawing 6 . As shown in drawing, the surface roughness of the rear face of the fixing belt 3 is influenced by the condition of the surface-roughness of a base material 17. Like drawing 5 , when the irregularity of a base material 17 is large, in the rear face of the fixing belt 3, the irregularity (projection) of 0.5 micrometers or more is seen by the whole surface. When sliding the fixing belt 3 and the forward temperature-coefficient resistance element heating element 2 in this condition, the field which touches the fixing belt 3 of the forward temperature-coefficient resistance element heating element 2 is worn out by projection. If sliding is furthermore continued, the projection of the fixing belt 3 can be deleted, it will deposit between the forward temperature-coefficient resistance element heating element 2 and the fixing belt 3, wear of the forward temperature-coefficient resistance element heating element 2 will be increased, and a life will be

reduced. The relation between the surface roughness of the rear face of the fixing belt 3 and the abrasion loss of the forward temperature coefficient resistance element heating element 2 is shown in drawing 4 . If surface roughness becomes large, the abrasion loss of the forward temperature coefficient resistance element heating element 2 will increase. Moreover, by deposition of a projection, the layer of air is made between the forward temperature-coefficient resistance element heating element 2 and the fixing belt 3, and heat conduction will worsen, will reduce the thermal efficiency of the forward temperature-coefficient resistance element heating element 2, and will cause degradation of image quality. Then, for this invention, the surface-roughness of the rear face of the fixing belt 3 as shown in drawing 6 is 0.5 micrometers. The smooth fixing belt 3 of the following is used. After this fixing belt 3 is manufactured by the electrocasting process, what has large surface roughness on the back removes irregularity by the approach as shown in drawing 7 . Also by performing this after treatment, it is the surface-roughness of 0.5 micrometers. The fixing belt 3 of the following is obtained.

[0015] Drawing 7 is the approach of removing the irregularity of the rear face of the fixing belt 3 using two rollers, a roller 20 and a roller 21. Pinch the fixing belt 3 in the pivotable condition between a roller 20 and a roller 21, pressing force is made to act in the direction shown in the roller 20 and the roller 21 by the arrow head, respectively, and a roller 20 and a roller 21 are rotated at uniform velocity. By making it rotate, making pressing force act, the irregularity of the rear face of the fixing belt 3 can be crushed, and a smooth field can be acquired.

[0016] Since the fixing belt 3 had thickness very as thin as 40-micrometer order, it adopted the metal belt in consideration of generating of the wrinkling by rotation of a belt etc. About the quality of the material, thermal conductivity was good and, moreover, used nickel with a low coefficient of thermal expansion compared with other metals. As for nickel, manufacture by the electrocasting process also has also in a metal the merit of being easy.

[0017] By using the fixing belt 3 by the above example for the belt type anchorage device 1, the abrasion loss of forward temperature coefficient resistance element heating element 2 front face is reduced, improvement in a life is achieved, and further, as shown in the temperature data on the front face of a belt of drawing 8 , improvement in the thermal efficiency of a heating element can also be aimed at. And even when the heat conductivity from the forward temperature coefficient resistance element heating element 2 is good and carries out long duration use by using the metallic belt by the electrocasting process, change of the diameter of a belt by thermal expansion, generating of a wrinkling, etc. can be prevented.

[0018]

[Effect of the Invention] It is 0.5 micrometers about the surface roughness of the field which touches the forward temperature coefficient resistance element heating element of a fixing belt in the electrophotography equipment which applied belt type fixing according to this invention. By considering as the following, reduction of wear of a forward temperature coefficient resistance element heating element front face and improvement in the thermal efficiency of a heating element can be aimed at. Moreover, the metallic belt by the electrocasting process, especially the heat conductivity are good, the heat conductivity from a forward temperature-coefficient resistance element heating element is good by using nickel belt with a low coefficient of thermal expansion, change of the diameter of a belt by thermal expansion, generating of a wrinkling, etc. can be prevented, and a high-definition image is obtained.

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TECHNICAL FIELD

[Industrial Application] This invention relates to the anchorage device of the method which gives the heat energy to record material through a belt, using a forward temperature-coefficient resistance element as a heating element.

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PRIOR ART

[Description of the Prior Art] Conventionally, the heat roller fixing method which consisted of pressurization rollers which it is covered with a heating roller with a heater and an elastic layer inside as an anchorage device used for image formation equipments, such as a copying machine and an optical printer, and carry out a pressure welding to a heating roller was used widely. However, there was a fault, like power consumption with the long warm uptime of a heating roller is large.
[0003] Then, the belt fixing method which conquers these faults is proposed variously. This belt fixing method is a method which a belt is contacted to a heating element, moves it to it, carries out pressurization adhesion of the record material in a field opposite to the heating element side of a belt, is made to carry out migration passage of the heating element location with a belt, and gives heat energy to record material through a belt from a heating element.
[0004] About the belt in this belt fixing method, the film of heat-resistant resin, such as polyimide, is used in JP,3-25475,A, and it is 0.5 micrometers about the surface roughness of the field by the side of the heating element of a film. It limited with 7 micrometers or less above, and the deviation of a film and generating of a wrinkling are prevented.

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EFFECT OF THE INVENTION

[Effect of the Invention] It is 0.5 micrometers about the surface roughness of the field which touches the forward temperature coefficient resistance element heating element of a fixing belt in the electrophotography equipment which applied belt type fixing according to this invention. By considering as the following, reduction of wear of a forward temperature coefficient resistance element heating element front face and improvement in the thermal efficiency of a heating element can be aimed at. Moreover, the metallic belt by the electrocasting process, especially the heat conductivity are good, the heat conductivity from a forward temperature-coefficient resistance element heating element is good by using nickel belt with a low coefficient of thermal expansion, change of the diameter of a belt by thermal expansion, generating of a wrinkling, etc. can be prevented, and a high-definition image is obtained.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] Surface roughness of 0.5 micrometers of the field by the side of the heating element of a film In case a film 7 micrometers or less slides with a heating element above, the problem that the thermal conductivity from a heating element to a film falls, and the thermal efficiency of a heating element falls by the deposition of a projection to which the front face of a heating element is worn out and the life of a heating element falls by early irregularity, and the heating element of a projection shaved off by repeating sliding and deposition of a between [films] occurs. Furthermore, when an endless-like resin film is used for a long time, by change of the diameter of a film by thermal expansion, and change of the frictional force of a heating element and a film, a film moves to shaft orientations or there is also a problem of a wrinkling occurring.

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MEANS

[Means for Solving the Problem] This invention is 0.5 micrometers about the surface roughness of the field which touches the heating element of a belt further using the metallic seamless belt by the electrocasting process in the anchorage device which heating fusion of the non-established toner image formed on the form is carried out [anchorage device] through a heat-resistant seamless belt, and fixes a toner image on a form. It was made to hold down to the following.

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OPERATION

[Function] It is 0.5 micrometers about the surface roughness of the field which touches the forward temperature coefficient resistance element heating element of the seamless belt of a belt anchorage device. By holding down to the following, the abrasion loss of a forward temperature coefficient resistance element heating element front face is reduced, improvement in a life is achieved, and improvement in the thermal efficiency of a heating element can also be aimed at further. Moreover, even when the thermal conductivity from a forward temperature coefficient resistance element heating element is good and carries out long duration use by using the metallic belt by the electrocasting process, change of the diameter of a film by thermal expansion and change of the frictional force of a heating element and a film are small, and can prevent migration to the shaft orientations of a belt, generating of a wrinkling, etc.

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EXAMPLE

[Example] Hereafter, the example of this invention is explained using a drawing.
[0009] The sectional view of the electrophotography equipment which applied the anchorage device of this invention to drawing 1 is shown. Separation feed is carried out and it conveys at a time one sheet of form 8 deposited in the hopper to the crookedness guide 12. With the conveyance roller 10, a form 8 is conveyed to the imprint section by which the toner on a photoconductor drum 15 is imprinted. The toner image on a photoconductor drum 15 is visualized by the developing machine 16. Then, a form 8 is conveyed to the belt type anchorage device 1 which consists of the metaled seamless fixing belt 3, a driving pulley 4, the forward temperature-coefficient resistance element heating element 2, the pressurization roller 5, an exfoliation roller 6, and an auxiliary roller 7, and it is fixed to a toner image to a form 8. The form 8 after fixing is sent to the crookedness guide 13 with the conveyance roller 14, and is taken out with the conveyance roller 11 to an output tray.
[0010] The configuration of the belt type anchorage device 1 is shown in drawing 2 . Hereafter, the actuation is explained.
[0011] The fixing belt 3 rotates in the direction of an arrow head A by the driving pulley 4, and is conveyed by the nip section N which touches the forward temperature coefficient resistance element heating element 2 and the pressurization roller 5 with the form 8 which carried the non-established toner 9. And after it is heated by the heat of the forward temperature coefficient resistance element heating element 2 and being enough cooled by air, it is separated by the exfoliation roller 6 with a form 8. Therefore, the non-established toner 9 on a form 8 is heated in the nip section N, and after melting, since it is cooled, it fixes in a form 8 and it dissociates with the fixing belt 3, elevated-temperature offset does not produce it.
[0012] The fixing belt 3 is thin enough so that the heat of the forward temperature coefficient resistance element heating element 2 may get across to a toner and a form 8 in an instant, and the fluororesin layer is given to the field in contact with a form 8. As an example, PTFE (tetrafluoroethylene resin) which added electric conduction material on the front face of the base material of nickel with a thickness of 30 micrometers is covered with the thickness of 20 micrometers.
[0013] The silicone rubber which has heat-resistant high coefficient of friction is covered by the driving pulley 4 and the front face of the auxiliary roller 7, and slipping of a driving pulley 4 and the fixing belt 3 is prevented. In addition, knurling tool processing which attaches minute irregularity to the front face of a driving pulley 4 other than silicone rubber may be performed. The configuration of the pressurization roller 5 is a reverse crown configuration in order to prevent the wrinkling of a form.
[0014] Next, the fixing belt 3 in this invention is explained. First, a electrocasting process is explained. The schematic diagram of a electrocasting process is shown in drawing 3 . Into metaled (for example, nickel) plating liquid 18, by dipping the metallic base material 17 equal to the bore of the fixing belt 3, connecting plating liquid 18 with this base material 17 with an electrode 19, and applying an electrical potential difference, the ion of metaled plating liquid 18 adheres to the front face of a base material 17, and forms a thin film. At this time, predetermined thickness can be obtained by controlling the time amount to which an electrical potential difference is applied. After predetermined thickness is obtained, it is removed from a base material 17 and the fixing belt 3 without a joint is done. The condition of the surface roughness of the field (rear face) which touches the forward temperature coefficient resistance element heating element 2 of the fixing belt 3 made by this process is shown in drawing 5 and drawing 6 . As shown in drawing, the surface roughness of the rear face of the fixing belt 3 is influenced by the condition of the surface-roughness of a base material 17. Like drawing 5 , when the irregularity of a base material 17 is large, in the rear face of the fixing belt 3, the irregularity

(projection) of 0.5 micrometers or more is seen by the whole surface. When sliding the fixing belt 3 and the forward temperature-coefficient resistance element heating element 2 in this condition, the field which touches the fixing belt 3 of the forward temperature-coefficient resistance element heating element 2 is worn out by projection. If sliding is furthermore continued, the projection of the fixing belt 3 can be deleted, it will deposit between the forward temperature-coefficient resistance element heating element 2 and the fixing belt 3, wear of the forward temperature-coefficient resistance element heating element 2 will be increased, and a life will be reduced. The relation between the surface roughness of the rear face of the fixing belt 3 and the abrasion loss of the forward temperature coefficient resistance element heating element 2 is shown in drawing 4 . If surface roughness becomes large, the abrasion loss of the forward temperature coefficient resistance element heating element 2 will increase. Moreover, by deposition of a projection, the layer of air is made between the forward temperature-coefficient resistance element heating element 2 and the fixing belt 3, and heat conduction will worsen, will reduce the thermal efficiency of the forward temperature-coefficient resistance element heating element 2, and will cause degradation of image quality. Then, for this invention, the surface-roughness of the rear face of the fixing belt 3 as shown in drawing 6 is 0.5 micrometers. The smooth fixing belt 3 of the following is used. After this fixing belt 3 is manufactured by the electrocasting process, what has large surface roughness on the back removes irregularity by the approach as shown in drawing 7 . Also by performing this after treatment, it is the surface-roughness of 0.5 micrometers. The fixing belt 3 of the following is obtained.

[0015] Drawing 7 is the approach of removing the irregularity of the rear face of the fixing belt 3 using two rollers, a roller 20 and a roller 21. Pinch the fixing belt 3 in the pivotable condition between a roller 20 and a roller 21, pressing force is made to act in the direction shown in the roller 20 and the roller 21 by the arrow head, respectively, and a roller 20 and a roller 21 are rotated at uniform velocity. By making it rotate, making pressing force act, the irregularity of the rear face of the fixing belt 3 can be crushed, and a smooth field can be acquired.

[0016] Since the fixing belt 3 had thickness very as thin as 40-micrometer order, it adopted the metal belt in consideration of generating of the wrinkling by rotation of a belt etc. About the quality of the material, thermal conductivity was good and, moreover, used nickel with a low coefficient of thermal expansion compared with other metals. As for nickel, manufacture by the electrocasting process also has also in a metal the merit of being easy.

[0017] By using the fixing belt 3 by the above example for the belt type anchorage device 1, the abrasion loss of forward temperature coefficient resistance element heating element 2 front face is reduced, improvement in a life is achieved, and further, as shown in the temperature data on the front face of a belt of drawing 8 , improvement in the thermal efficiency of a heating element can also be aimed at. And even when the heat conductivity from the forward temperature coefficient resistance element heating element 2 is good and carries out long duration use by using the metallic belt by the electrocasting process, change of the diameter of a belt by thermal expansion, generating of a wrinkling, etc. can be prevented.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The sectional view of the electrophotography equipment which applied the anchorage device of this invention.
[Drawing 2] The sectional view of the belt type anchorage device which applied the fixing belt of this invention.
[Drawing 3] The explanatory view of a electrocasting process.
[Drawing 4] The explanatory view of the relation between the surface roughness on the rear face of a fixing belt, and the abrasion loss of a forward temperature coefficient resistance element heating element front face.
[Drawing 5] The state diagram on the rear face of a fixing belt (concavo-convex size of a base material).
[Drawing 6] The state diagram on the rear face of a fixing belt (concavo-convex smallness of a base material).
[Drawing 7] The explanatory view of the removal approach of the irregularity on the rear face of a fixing belt.
[Drawing 8] The temperature profile of the fixing belt front face of the forward temperature-coefficient resistance element exoergic section.
[Description of Notations]
2 [-- A pressurization roller, 6 / -- An exfoliation roller, 7 / -- An auxiliary roller, 8 / -- A form, 9 / -- Non-established toner.] -- A forward temperature-coefficient resistance element heating element, 3 -- A fixing belt, 4 -- A driving pulley, 5

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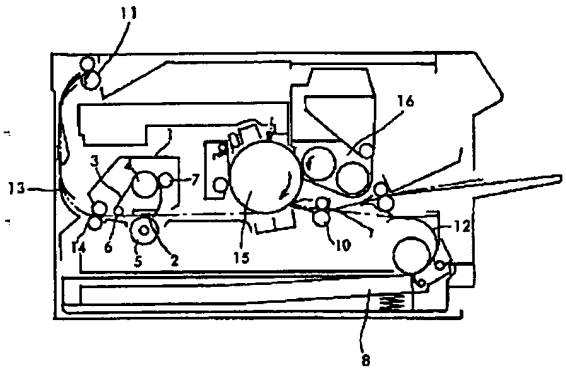
DRAWINGS

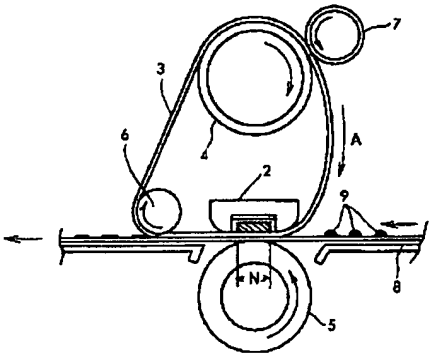
[Drawing 1]

図 1



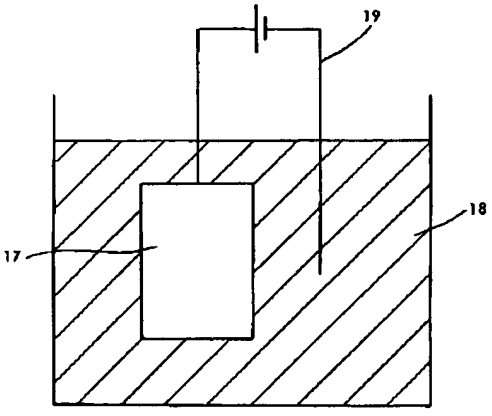
[Drawing 2]

図 2



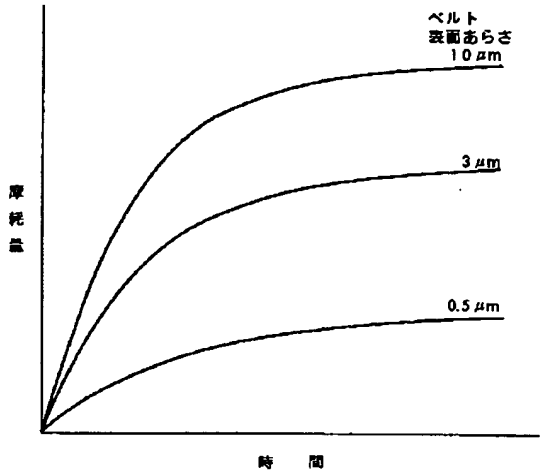
[Drawing 3]

図 3



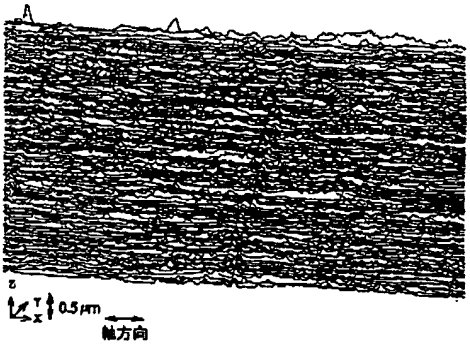
[Drawing 4]

図 4



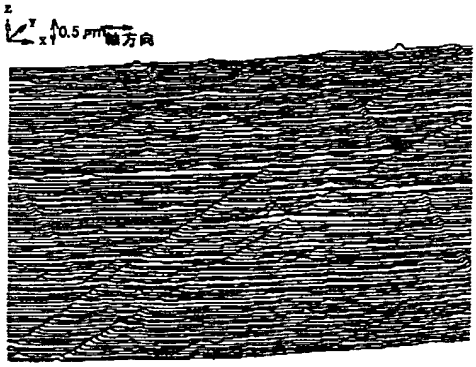
[Drawing 5]

図 5



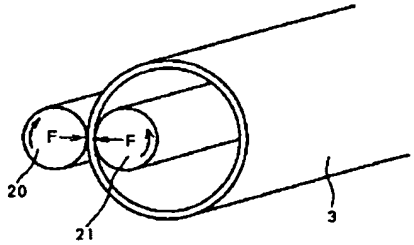
[Drawing 6]

図 6



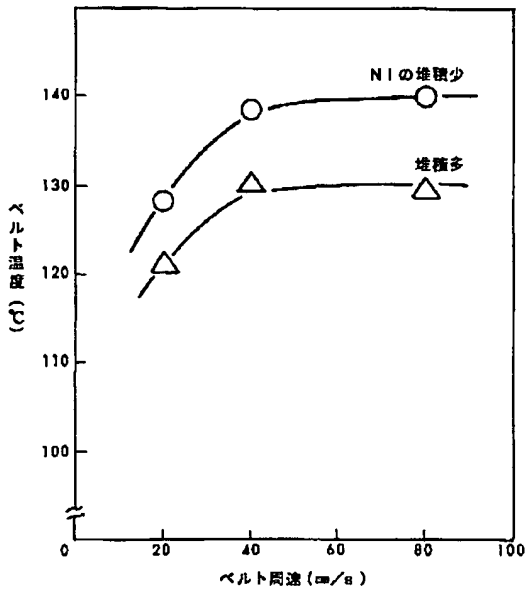
[Drawing 7]

図 7



[Drawing 8]

図 8



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